REMARKS

Claims 1-8, 10 and 19-24 remain pending in the present application. Claims 9 and 11-18 have been canceled. Claims 1 and 10 have been amended. Claims 19-24 are new. Basis for the amendments can be found throughout the specification, claims and drawings as originally filed.

Requested Translations

The Examiner has requested translations of JA7-47831, JA5-124,426 and JA 62-29411. Enclosed with this response are the translations of these three references.

Rejections Under 35 U.S.C. § 103

Claims 1, 3-8 and 10 are rejected under 35 U.S.C. § 103(a) as being unpatentable over prior art Figure 11C and Figure 11D in view of JA '411 or JA '831 or JA '426 and JA '645. The Examiner has based his rejection of Figures 11A-11D of the present application which are labeled "PRIOR ART". These Figures were mistakenly identified as prior art by the Applicants, when in fact, these drawings are the same as Figures 8a to 8d of JP8-152721 which is one of the priority documents for the parent application and the present application. Enclosed with this amendment is a copy of Figures 8c-8d and a translation of the portion of priority document JP8-152721 which relates to Figures 8a-8d of that priority application. As can be seen, Figures 8a-8d of the JP8-152721 are identical to Figures 11A-11D of the present application and the specification of the priority document is similar to that of the present application (page 5 of the translation and page 25 of the application). The present application has therefore been amended to remove the "PRIOR ART" designation for Figures 11A-11D.

In each of references JA '411, JA '831 and JA '426, a double laminar mode can be set. However, an arrangement position of a temperature sensor for detecting a cooling temperature of the cooling heat exchanger and an operation control of the temperature sensor are not described. On the other hand, JA '645 describes a normal air conditioner in which the double

laminar mode is **not** set. In JA '645, the set temperature of past-evaporator sensor is decreased when the outside air temperature is low. However, there is **not** caused any problem due to both-flow introduction of inside air and outside air, **having different temperatures,** into the cooling heat exchanger.

According to experiments of the inventors of the present invention, for example, when a temperature sensor is **simply** disposed in the first air passage (inside air passage) in the winter where the outside air temperature is lower than the inside air temperature, as shown in Figure 11B, the temperature of outside air blown from the evaporator (7) is lower than the temperature of inside air blown from the evaporator because the operation of the evaporator is controlled only based on the temperature of inside air from the evaporator. Therefore, in the winter, the cooling temperature of the evaporator may be lower than 0°C, and the evaporator may be frosted. For overcoming this problem, when a sensor set temperature is increased (e.g., from 3°C to 5°C), the temperature of outside air from the evaporator is increased to 7-8°C, and cooling performance and dehumidifying performance of the evaporator become insufficient. On the other hand, when the temperature sensor is **simply** disposed in the second air passage (outside air passage) as shown in Figures 11C and 11D, the same problem described above is caused because the operation of the evaporator is controlled only by the temperature of outside air from the evaporator. Thus, in the present invention, the set temperature of the temperature sensor (39) is changed in accordance with the outside air temperature. Accordingly, the feature of the present invention is completely different from that of each reference.

Thus, Applicant believes Claims 1, 3-8 and 10 patentably distinguish over the art of record. Reconsideration of the rejection is respectfully requested.

New Claims

New Claims 19-24 are dependent claims ultimately depending from one of the original independent claims of the present invention.

In light of the above amendments and remarks, Applicants would submit that all Claims are in a condition for allowance and thus Applicants request that the Examiner pass the case to issue at his earliest possible convenience.

Should the Examiner have any questions regarding the present amendment he should not hesitate to contact the undersigned at (248) 641-1600.

Respectfully submitted,

HARNESS, DICKEY & PIERCE, P.L.C.

June 7, 2000
Date

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Attorney Docket: 4041J0063CPA

TRANSLATION RELATIVE TO THE PARTS OF FIGS, 11A-11D.

(Application Number: Hei. 8-152721)

(Application Date: June 13, 1996)

(Applicant: Nippon Denso Co., Ltd)

[DETAIL DESCRIPTION OF THE INVENTION]

[0001]

[FIELD OF THE INVENTION]

The invention relates to an air conditioning apparatus for a vehicle, in which a first air passage and a second air passage are formed in an air conditioning case, and inside air and outside air can be introduced into the first air passage and the second air passage, respectively.

[0002]

[PRIOR ART]

In a conventional air conditioning apparatus disclosed in JP-A-5-125526, there are formed at one end side of an air conditioning case an inside-air inlet and an outside-air inlet, and at the other end side of the air conditioning case a foot air outlet, a defroster air outlet and a face air outlet.

[0003]

Within the air conditioning case, a partition plate is provided so that an interior of the air conditioning case is partitioned into a first air passage extending from the inside-air inlet to the face air outlet and the foot air outlet, and a second air passage extending from the outside-air inlet to the defroster air outlet.

Further, in both the first and second air passages, there

are provided a cooling evaporator, a heating heat exchanger, a bypass passage bypassing the heating heat exchanger, and an air mixing door.

[0004]

When any one of the face mode, the bi-level mode and the foot mode is selected as an air outlet mode, if an inside/outside air introduction mode is an inside air introduction mode, inside air is introduced into both the air passages, whereas if the mode is an outside air introduction mode, outside air is introduced into both the air passages. Further, when a defroster mode is selected as the air outlet mode, outside air is introduced into both the air passages.

[0005]

Further, a foot/defroster mode is selected as the air outlet mode, an inside/outside air double laminar mode is set so that inside air is introduced into the first air passage and outside air is introduced into the second air passage. In this way, because a passenger compartment is heated by a recirculation of inside air which has been already heated, heating performance is improved. Further, because outside air having a low humidity is blown toward a windshield, it is possible to obtain the defrosting performance of the windshield certainly.

[0006]

[PROBLEM TO BE SOLVED BY THE INVENTION]

However, the conventional apparatus does not describe regarding a control for preventing a frosting of the cooling evaporator. The inventors of the present invention have

experimentally produced a vehicle air conditioning apparatus having a function of the above-described inside/outside air double laminar mode, and studied the control for preventing the frosting of the cooling evaporator. As a result, it turns out that the following problem occurs.

[0007]

That is, in the vehicle air conditioning apparatus, as being well known, operation of a compressor for circulating refrigerant in the cooling evaporator is intermitted according to a cooling temperature (more specifically, the temperature of air just blown out from the evaporator) of the cooling evaporator, so that the cooling temperature of the cooling evaporator is maintained at a set temperature (e.g., 3℃ - 4℃). In this way, the frosting of the cooling evaporator is prevented.

[0008]

Here, as shown in FIGS. 8 (a) and (b), in a case where a temperature sensor 39 for detecting the cooling temperature of the cooling evaporator 7 (more specifically, the temperature of blown-air) is disposed in the inside-air passage (the first air passage) 13, in the summer season where the outside-air temperature is high, the temperature of air blown from the cooling evaporator 7 in the outside-air passage (the second air passage) 14 is higher than that in the inside-air passage 13 as shown in FIG. 8(a), because the high-temperature outside air flows into the outside-air passage 14.

[0009]

On the other hand, in the winter season where the outside-air temperature is low, as shown in FIG. 8(b), the temperature of

air blown from the cooling evaporator 7 in the outside-air passage 14 is lower than that in inside-air passage 13 (see FIG. 9 described later), because the low-temperature outside air flows into the outside-air passage 14. Accordingly, in the winter season, the cooling temperature of the cooling evaporator 7 in the outside-air passage 14 is lowered less than 0℃ so that the evaporator 7 may be frosted.

[0010]

Conversely, FIGS. 8(c) and 8(d) show a case where the temperature sensor 39 is disposed in the outside-air passage 14. In the summer season where the outside-air temperature is high, the temperature of air blown from the cooling evaporator 7 in the inside-air passage 13 is lower than that in the outside-air passage 14, as shown in FIG. 8(c), because the low-temperature inside air flows into the inside-air passage 13. Therefore, in order to prevent the frosting of the cooling evaporator 7 in the inside-air passage 13 certainly, a set temperature of the temperature sensor 39 needs to be higher than the cases shown in FIGS. 8(a), 8(b) (e.g., by 5℃ - 6℃).

[0011]

However, if the set temperature of the temperature sensor 39 is set to be higher as described above, in the winter season where the outside-air temperature is low, the temperature of the blown-air in the inside-air passage 13 is increased to a temperature (e.g., 10℃) as shown in FIG. 8(d). Therefore, there occurs a problem that the dehumidifying capacity for the inside air is insufficient.

.....

.....

(Second Embodiment)

The second embodiment differs from the first embodiment in that the post-evaporator sensor 39 is disposed in the outside-air passage (in the second air passage 14) and the process of step 180a in FIG. 6 is modified. The other features of the second embodiment are the same as those in the first embodiment.

[0057]

As described above with reference to FIGS. 8(c) and 8(d), when the post-evaporator temperature sensor 39 is disposed at the outside-air side (i.e., at the side of the second air passage 14) of the evaporator 7, the temperature of inside air blown from the evaporator 7 in the inside-air passage 13 is increased in the winter season, so that the dehumidifying capacity is decreased.

.....

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[BRIEF DESCRIPTION OF THE DRAWINGS]

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FIGS. 8(a)-8(d) are sectional views of a main part of a ventilation system for explaining problems of a conventional air conditioning unit.

.....

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FIG. 10

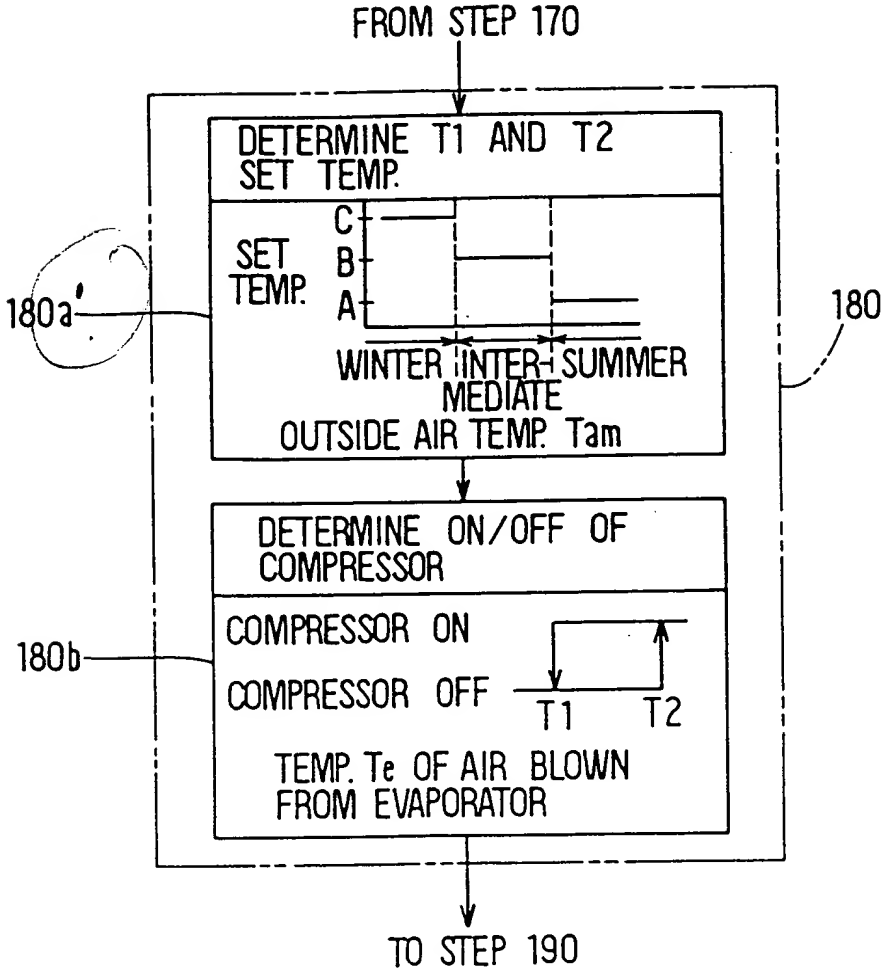


FIG. 11A PRIOR ART

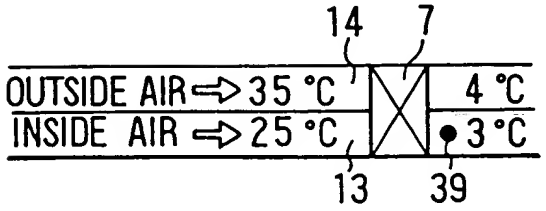


FIG. 11B PRIOR ART

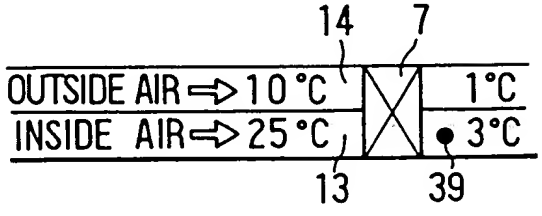


FIG. 11C PRIOR ART

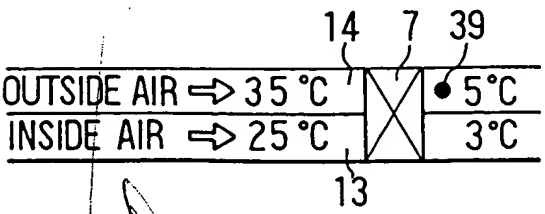


FIG. 11D PRIOR ART

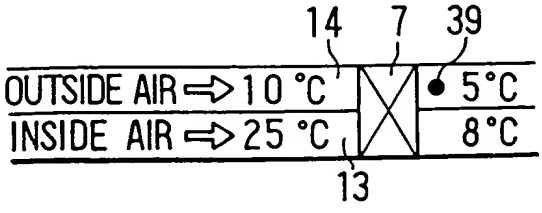


FIG. 10

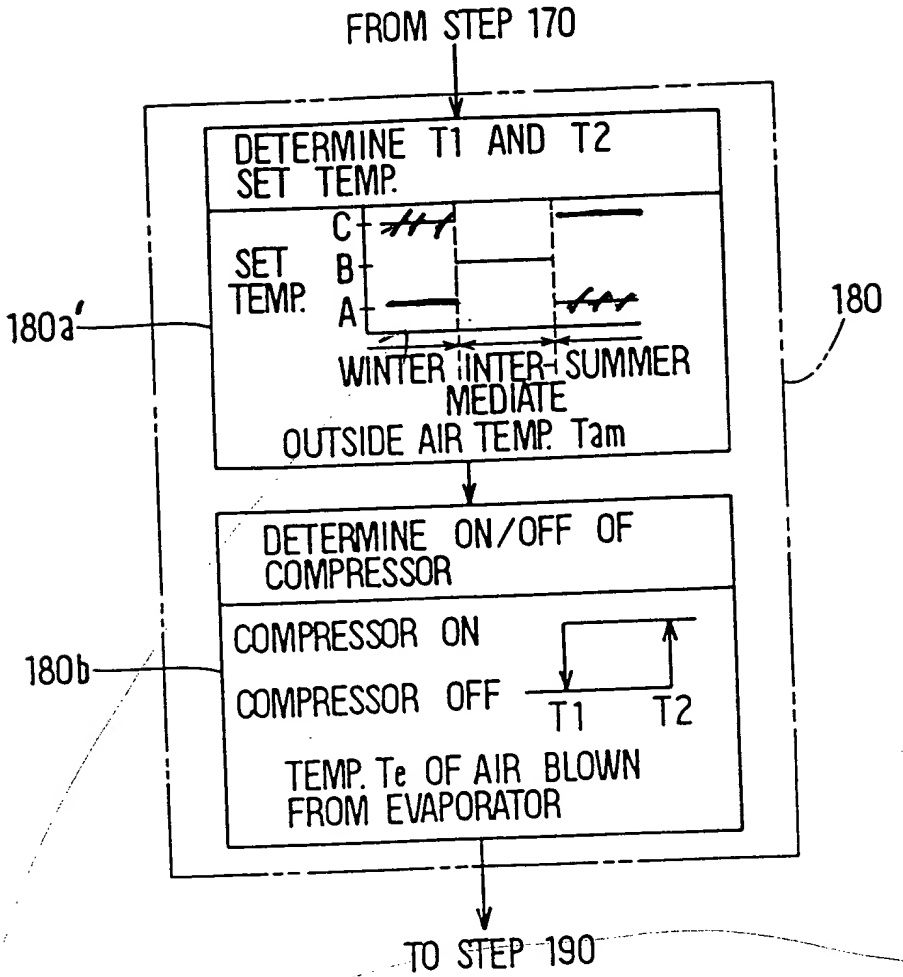


FIG. 11A PRIOR ART

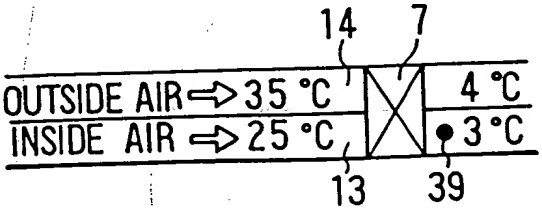


FIG. 11B PRIOR ART

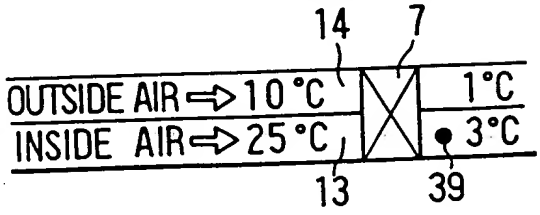


FIG. 11C PRIOR ART

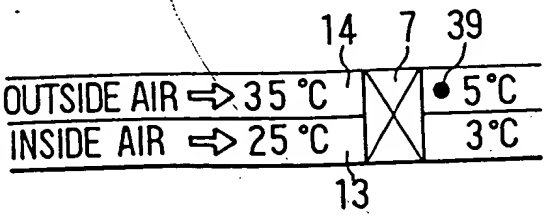


FIG. 11D PRIOR ART

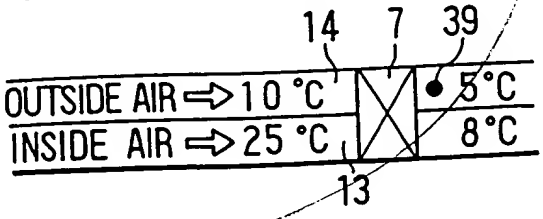
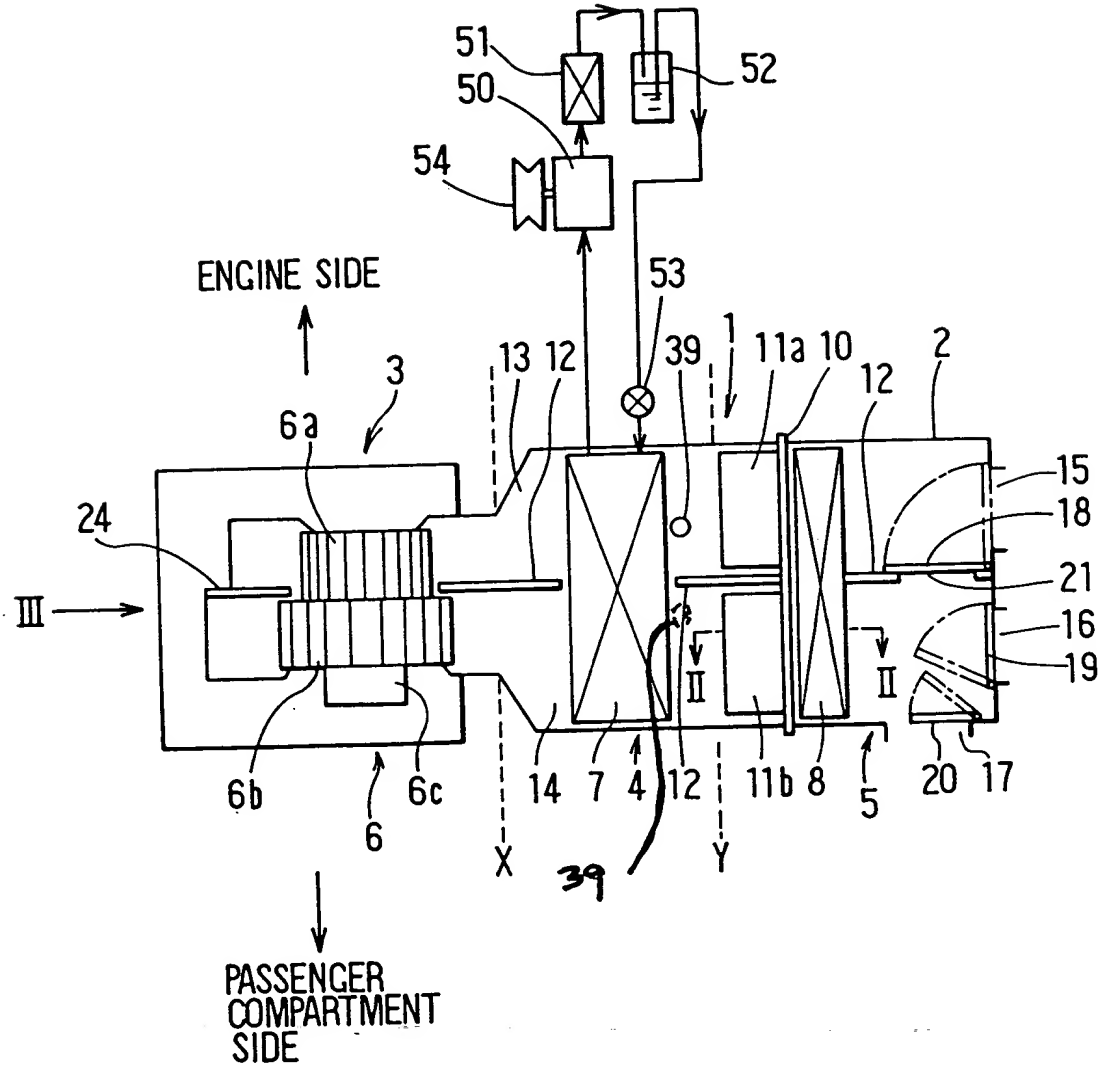


FIG. 1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ENGINE SIDE
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III
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11b
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X
39
Y
PASSENGER
COMPARTMENT
SIDE